

REMARKS

The subject invention relates to an apparatus for optically inspecting semiconductor wafers. As noted in the specification, it is critical for semiconductor manufacturers to monitor wafers during processing. In particular, it is desirable to monitor the characteristics of thin film layers deposited on the surface of semiconductor substrates. Useful measurement tools include, for example, spectrophotometers, spectroscopic ellipsometers and narrow band ellipsometers.

It had been observed that if the same wafer was measured at different times, different measurement results were obtained. That problem was then traced to the presence of a varying contaminant layer on the wafer surface. Further, it was determined that if this contaminant layer could be removed prior to measurement, the analysis of wafer characteristics could be made with greater repeatability.

As noted in the specification at page 3, many conventional cleaning approaches required the use of cleaning solutions. Such cleaning solutions could damage or contaminate the structures being formed on the semiconductor surface. Accordingly, it is believed that one or more non-contact cleaning modalities were necessary. As noted in claim 1, these modalities can include microwave excitation, radiant heating, conductive heating and optical radiation.

Turning to the Office Action, the Examiner noted a typographical error in claim 1. This error is corrected in this amendment. Claim 1 has also been amended for clarity. More specifically, original claim 1 included the language: "said cleaning system functioning to reduce contaminants on the wafer so that the analysis of the wafer by the optical inspection system can be more accurate." These concepts have now been expressly added immediately after the initial recitation of the corresponding elements in claim 1. It is submitted that this amendment does not narrow the scope of the claim and is being made to insure that the claim is interpreted as originally intended.

In the Office Action, the claims were rejected as being obvious based on the patent to Miyai (5,825,470) in view of the patent to Yoshii (5,625,657) and in further view of the Imen article, "Laser Assisted Micron Scale Particle Removal."

In the Office Action, the Examiner asserted that Miyai discloses an optical inspection systems (56, 58) coupled to a cleaning system 106 functioning to reduce contaminants on a wafer 34. It is submitted, however, that the teachings of Miyai are quite different from applicants' claimed invention.

First, and most importantly, the cleaning system 106 in Miyai is **not** for cleaning wafers. Rather, the cleaning system 106 is for cleaning the holders 44 which support the wafer. Secondly, the cleaning system 106 includes a water tank 118. As noted above, liquid cleaning is unacceptable.

Still further, the elements 56 and 58 do not define an “optical inspection” system as suggested by the Examiner. Rather, and as noted at column 9, lines 35+ of Miyai, these elements are simply part of an autofocus system for detecting the vertical height of the wafer. This optical system of Miyai is not for the purpose of analyzing the characteristics of a wafer.

Since Miyai discloses neither a system for cleaning wafers nor an optical inspection system, it cannot form the primary basis for a prior art rejection.

The patent to Yoshii was cited by the Examiner for teaching an optical inspection system operatively coupled to a cleaning system functioning to reduce contaminants on a wafer. In fact, Yoshii does not relate to either wafer inspection or cleaning. Yoshii relates to the inspection of a “pellicle” such as a recticle or photomask. Yoshii is concerned with detecting particles on the surface of a pellicle. Accordingly, his inspection system consists of a laser generating a beam which is scanned over the sample. To the extent particles are present, the beam will be scattered and therefore the particles can be detected. Even if Yoshii taught that this approach should be used on wafer, this type of inspection system is not one of the claimed inspection systems, specifically, a spectrophotometer, a spectroscopic ellipsometer or a narrow band ellipsometer.

The cleaning system 921 of Yoshi is also for pellicles not wafers. In addition, the cleaning system consists of a water bath, which as noted above, is not acceptable.

The Imen article was cited for disclosing a cleaning system which includes optical radiation in an apparatus for evaluating a wafer. However, Imen’s cleaning system is also water based. Specifically, the surface of the wafer must first be “dosed” with water. Then the surface of the wafer is irradiated with a pulsed laser. *“The resulting **explosive** evaporation of the absorbed water molecules generates forces many orders of magnitude larger than the adhesion forces between the particle and substrate and propels the particle off the substrate **much like a miniature rocket engine.**”* (Page 320) It is respectfully submitted that the “explosive,” liquid based cleaning approach of Imen is not equivalent to any of the non-contact cleaning approaches set forth in applicants’ claim 1.

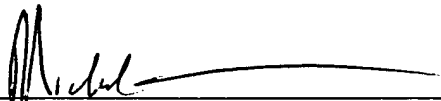
It should also be noted that Figure 1 of Imen shows an "optical microscope" in the experimental set up. This microscope was used to collect an image of the wafer surface in order to evaluate the effectiveness of the "explosive" cleaning method. An optical microscope, which function merely to collect an "image" of a sample, is not equivalent to any of the optical inspection systems of the type set forth in applicants' claim 1 which are capable of evaluating subsurface characteristics of a sample.

In summary, it is respectfully submitted that none of the prior art cited by the Examiner, whether taken alone or in combination, teaches or suggests the subject matter of claim 1 which includes an optical inspection system such as "a spectrophotometer, a spectroscopic ellipsometer or a narrow band ellipsometer," operatively coupled with a system for cleaning a wafer such as "microwave excitation, radiant heating, conductive heating or optical radiation" such that the analysis of the wafer by the optical inspection system can be more accurate. Accordingly, it is submitted that the claims define patentable subject matter and allowance thereof is respectfully requested.

Respectfully submitted,

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